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INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE SALMON FISHERIES IN
THE FRASER RIVER SYSTEM

ANNUAL REPORT
1952

COMMISSIONERS

ROBERT J. SCHOETTLER
A. J. WHITMORE
ELTON B. JONES
SENATOR THOMAS REID
ALBERT M. DAY
H. R. MacMILLAN

NEW WESTMINSTER
CANADA
1953

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

MEMBERS

AND PERIOD OF SERVICE

SINCE THE INCEPTION OF THE COMMISSION

IN 1937

CANADA		UNITED STATES	
William A. Found	1937-1939	Edward W. Allen	1937-1951
A. L. Hager	1937-1948	B. M. Brennan	1937-1942
Senator Thomas Reid	1937-	Charles E. Jackson	1937-1946
A. J. Whitmore	1939-	Fred J. Foster	1943-1947
Olof Hanson	1948-1952	Milo Moore	1946-1949
H. R. MacMillan, C.B.E., D.Sc.	1952-	Albert M. Day	1947-
		Alvin Anderson	1949-1950
		Robert J. Schoettler	1951-
		Elton B. Jones	1951-

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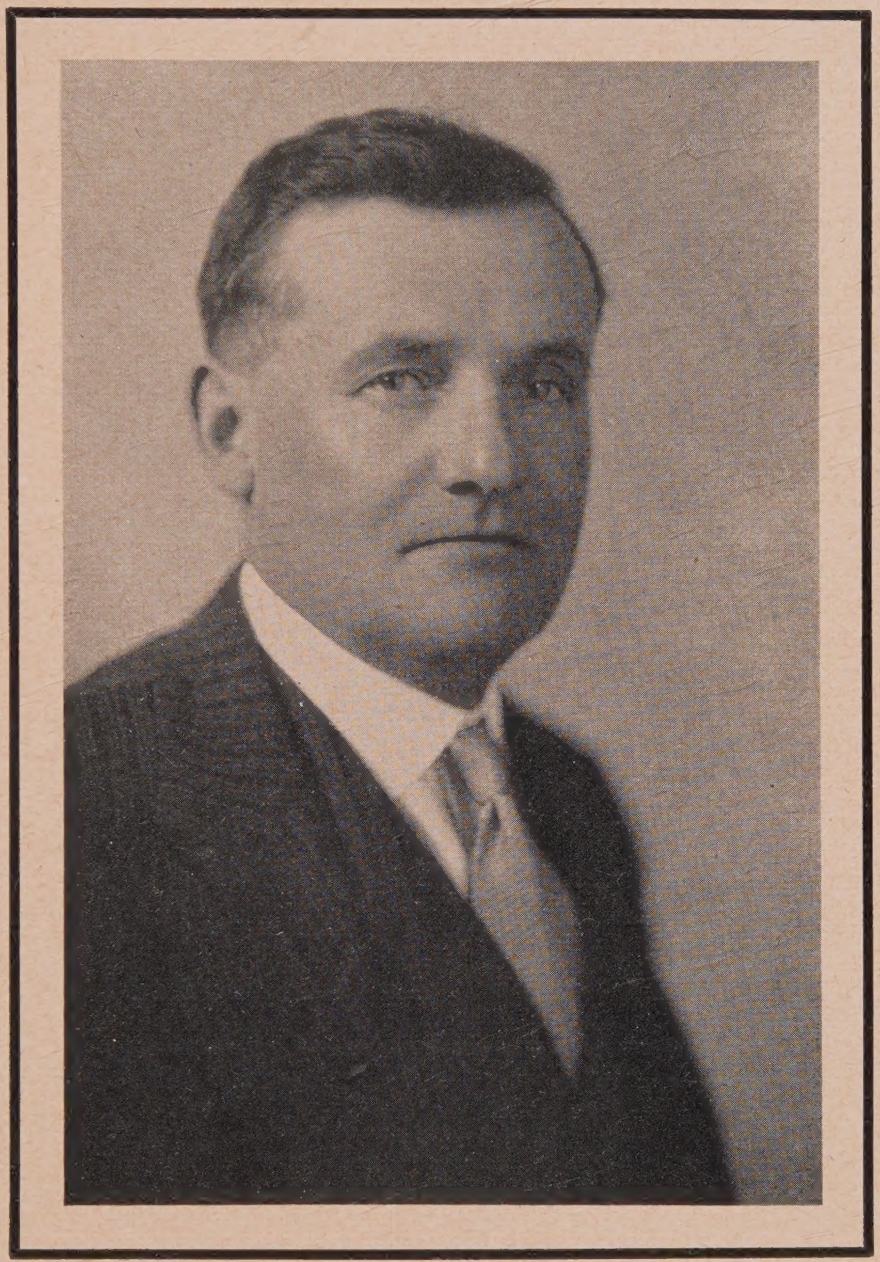
OLOF HANSON
(January to June)
H. R. MacMILLAN
(July to December)

OFFICERS

LOYD A. ROYAL
Director

ROY I. JACKSON
Assistant Director

NEW WESTMINSTER
CANADA
1953



OLOF HANSON

Member of the International Pacific Salmon Fisheries Commission who passed away on June 4, 1952. Mr. Hanson was a pioneer in the development of British Columbia, spending a great deal of his personal time furthering the work of the Commission. His great understanding of human nature always created a friendly spirit among both commissioners and members of the staff.

REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1952

The Fraser River sockeye run in 1952 provided a repetition of the record-breaking achievement of the 1951 run. In 1951 the catch of Fraser River sockeye exceeded that of any previous cycle-year since 1903, contributing $8,232,000 more to the economy of Canada and the United States than was provided in 1947, the preceding cycle-year. The sockeye run in 1952 was the largest of any cycle-year since 1912, and the total pack was equalled during that period in only one cycle-year, 1936, at which time the spawning escapement was negligible. The run in 1952 not only produced 78,361 cases of canned sockeye more than was taken from the preceding cycle-run but it provided satisfactory or increased escapements to all of the individual spawning grounds. The selling value of the increased pack was approximately $2,755,000.

The recommendation of the International Pacific Salmon Fisheries Commission to build the Hell's Gate fishways in 1945 and the formulation of scientifically based recommendations for regulating the fishery since 1946 are now of proven value to the economy of the region. The millions of dollars gained by the fishery during the past two years exceeds many times the entire cost of the Commission's efforts to rehabilitate the Fraser River sockeye runs.

The task of the Commission, as defined in a Convention between Canada and the United States, ratified on July 28, 1937, is to protect, preserve and extend the sockeye salmon fishery of the Fraser River system. The great increase in the runs of the last two years has given rise to optimism that this task will soon be finished. This is not the case even though once-great runs such as the Quesnel run are showing or indicating substantial increases in their returning populations. The average rise in the catch may be a gradual one, subject to occasional and temporary setbacks. The Hell's Gate block from 1913 to 1945 destroyed the great run every fourth year as well as seriously injuring the runs of each annual cycle. Individual races of sockeye reproducing in the same watershed were injured in a varying degree. In this manner the original stability of the populations of sockeye in relation to their freshwater environment has been upset or perhaps destroyed. The regaining of this stability involves important biological adjustments. With increasing escapements, annual cycles must again harmonize with each other that one may emerge as the dominant one of the four. Various races migrating in the same year to the same watershed now appear in some cases to have a relationship to each other in population size somewhat different or even opposite to that originally existing. While these biological adjustments take place and the races of sockeye regain their historic stability and their normal relationship to each other, occasional negative variation may occur in the expected survival rate of a spawning population.

These disappointing survival rates, when they occur, may have no relationship to adverse and temporary environmental influences and may be the result of the expected readjustment of the populations to their normal cyclic relationship.

In spite of the existence of these necessary biological adjustments and the possibility of occasional poor runs, the average trend in the annual catches should go up toward an eventual maximum level with a higher and higher return to the fishing industry and the people of both countries. With science guiding the regulation of the fishery it appears that this favorable economic trend in the Fraser River sockeye fishery will continue. However, artificial changes brought about by man himself in developing the other resources provided by the watershed could interfere with this expected increase in the sockeye population. The dangers of such developments have already been manifested. The "Billion Dollar Loss" of Fraser River sockeye because of the Hell's Gate slide is related to the construction of a railroad. The early depletion of the Quesnel sockeye is related to a gold-mining project. The destruction of the once-important upper Adams run is related to logging operations as well as to the Hell's Gate slide. All of these disastrous happenings are now a historical record. All could have been prevented by intelligent and imaginative planning. A new and intensified development of the resources inherent in the Fraser River basin commenced in recent years, may continue at even a more rapid rate in the future. It is obvious that the effects of this development should be considered in relation to the possible future of the Fraser River sockeye populations. The basis usually controlling these considerations is that all resource development should be adjusted in such a manner that the freshwater environment of the sockeye will not be seriously affected because the sockeye population cannot adjust itself to major environmental changes. This fact was obvious in the three historical instances itemized above. The question is: Can a proper element of mutual tolerance and respect be brought about between general resource development and the development of the sockeye resource in the Fraser River basin? The necessary mutual tolerance and respect has not always existed in the past and we must consider the possibilities of its existence in the future.

The important basic resources other than fish in the Fraser basin are land, minerals, timber, and hydro-electric power. People might well be classed as a resource since they too have a place in the considerations to follow.

Land

Many thousands of acres of tillable but semi-arid land lie undeveloped in the Fraser basin. Much of this type of land lies in the Thompson River valley where pumping stations supplied by cheap power could provide the necessary water for practical irrigation. As the population of Canada increases, the need for developing this land will become increasingly

important. Cheap power eventually will be provided to pump water for bringing some of this land into production. Irrigation of semi-arid sections in other areas such as the Columbia basin has had a disastrous effect on the salmon populations. In the case of the Columbia basin, the acreage available for development in some instances actually exceeded the available and adjacent water supplies. This is not true in the Fraser basin. Water appears to be available in surplus quantities for both fish and irrigation. The development of the salmon resources and the development of irrigation by pumping can proceed side by side with little or no conflict. Fish screens of modest cost are the only protection required by the fisheries resource.

The Salmon River, a tributary of Shuswap Lake, is the only area where land development and the rehabilitation of the sockeye populations may be in partial conflict. Sufficient water appears to be available even in this area for both irrigation and salmon propagation, unless the remaining water were diverted to a point outside of the watershed. However, the number of licensed diversions is so great that the careless use or excessive diversion of water by one or more users might jeopardize the existing salmon runs and endanger the rehabilitation of the once important sockeye run to this stream. Careless or wasteful use of water is never permitted in good watershed management, hence a simple recognition of that fact is all that is necessary to eliminate any possible lack of harmony in the development of the land and the salmon resource.

Minerals

The gold rush up the Fraser River started in 1858. Since that time mining has flourished almost continuously in British Columbia. Gold has contributed millions of dollars annually, and additional wealth has been produced from other minerals. With minor exceptions, the only conflict that has ever developed between mining and the sockeye of the Fraser basin was the disastrous Quesnel River development. Fortunately for the sockeye the project ended in bankruptcy. The Quesnel sockeye runs were able to completely recover before being once again practically exterminated by the Hell's Gate slide. No known conflicts exist today between the great mining industry and the Fraser River sockeye industry. The development of certain potential placer mine projects could upset sockeye rehabilitation plans, but a study of these potential projects shows that they are questionable from an economic standpoint, consequently a failure to develop them would not be important to the economic development of the basin. Future developments may require some control of mining wastes, but such control is usually established practice elsewhere and to date no difficulty has occurred in this connection.

Timber

The development of the timber resources of British Columbia has been confined principally to the coastal areas until recent years. The manufacture

of lumber from the timber resources of the Fraser basin is now increasing at a rapid rate. The cut of timber in the Fraser basin for 1951 approached 1,000,000,000 F.B.M. Because of the character of the timber resources little change in the character of the watershed cover is expected to occur, especially when the harvest is made on a sustained yield basis. Many of the spawning watersheds are used as a means of transportation for timber products, but in only one case has the development of the timber and fisheries resources met in conflict; a splash dam located at the outlet of Adams Lake not only destroyed the valuable upper Adams River run but seriously injured the large lower Adams River run. With modern methods of transportation the need for such dams appears to have disappeared entirely, for their use has been discontinued throughout North America. Lumber and sockeye need have no conflict in the years to come.

The growing demand for pulp products will eventually lead to the utilization of the great supply of pulp timber available in the Fraser basin. Fortunately, the species of available timber are particularly suited to the sulphate process of pulp manufacture. This pulping process entails the evaporation and burning of its waste products thus eliminating a great potential source of serious pollution. Processing chemicals are recovered, and the operation is almost self-sustaining in its power requirements. By using standard methods of pollution control which are an accepted economic part of modern sulphate pulp manufacture, considerable development of this type can take place with no apparent injury to the sockeye resource. Pulp mills use vast quantities of water, but if the diversion of water is made without the use of obstructing dams and if the diversion is adequately screened no adverse effects on the sockeye resource are expected from this extensive use of water.

People

Resource development is accompanied of necessity by an increasing population. People gathering in towns and cities require sewers and thus create potential pollution problems. Modern health standards, however, normally require sewage treatment to eliminate the deleterious effects of pollution long before a fisheries problem is created. This is exemplified in the current plans for the control of pollution in the center of population adjoining the mouth of the Fraser River. Under the present plans being formulated to protect the health and welfare of the people all sewage will be gradually collected by interceptor sewers and treated before being discharged into the waterways. The required protection being afforded the health of the people will embrace the fish populations as well.

The growth of the towns and cities as well as the development of land located in the Fraser Valley will be associated with the construction of new food processing plants, factories, refineries and other processing plants which will increase the potential organic effluent which might be discharged into the Fraser River. This effluent also must be treated if the quality of the

Fraser River water is to be maintained at reasonably high standards for other required uses. The protection of fish from pollution is merely an added reason for maintaining reasonably high standards of water purity.

Water supplies necessary to meet the needs of an increasing population will probably be obtained either by pumping from wells and from adjoining river systems or through gravity systems from non-sockeye producing watersheds. Gravity water systems requiring the construction of dams on sockeye producing rivers do not appear to be economically practical. None of the expected water supply developments need have any ill effects on the sockeye populations.

The need for flood protection is created by a rapidly increasing population located in a major river basin. The land in the river valleys is almost always the most fertile for the production of food and industrial plants and towns usually border the waterways. The "ten," "twenty-five" or "fifty year" flood peak may cause extensive damage. The solution to the flood damage problem is a very complex one. In fact, the problem is so complex when dealing with a major river system that it has never been solved to a satisfactory degree. This is most evident in the Missouri-Mississippi basin where hundreds of millions of dollars have been expended for this purpose and yet flood damage still occurs periodically to a tragic and serious economic extent. As a result of the 1948 flood on the Fraser River, extensive work was carried out to raise, strengthen and augment the diking system of the lower delta. This type of flood protection is utilized throughout the world and has proven to be as effective a method of control as any other method now in use. This method does not affect the reproduction of sockeye salmon. Another method and only an auxiliary method at best is upstream storage. The large lake systems in the Fraser Valley are particularly adaptable to this method of flood control but not sufficiently so to eliminate the need for dikes.

If upstream storage were provided as an auxiliary method of flood control it could jeopardize every major sockeye producing area unless extreme care were used in planning the development. In some areas, such as the Tweedsmuir Park district of the Nechako watershed and the upper North Thompson River, flood runoff could be controlled with no damage to the fisheries resource. In other major lake areas such as Chilko Lake either flood control or hydro-electric power development would exterminate the sockeye population because neither development could be harmonized with the successful reproduction of the sockeye resource.

Since the diking method of flood control will always be a necessity, especially in the lower delta of the Fraser River, it is to be hoped that the uncertain auxiliary method of utilizing upstream storage will not be required. The uncertainty of the storage method of flood control lies partially in the inability to always estimate accurately the peak runoff from 90,000 square miles of watershed and time storage operations in accordance

FIGURE 1. Biologists collecting scale samples and growth data from dead jack sockeye on the banks of the Horsefly River, principal spawning area of the famous Quesnel run. 6,829 three-year-old males were recorded in the 1952 run.

with the flood danger period in the lower valley located several hundred miles downstream from the point of storage. If upstream storage is required it can be accomplished to some extent, and perhaps to the necessary degree, without creating a serious danger to the future of the fishing industry if in the planning of the project the full requirements for successful salmon reproduction are fully realized.

Hydro-electric Power Development

It is estimated that undeveloped hydro-electric power in the amount of 15,100,000 gross h.p. is available in British Columbia. This undeveloped energy is distributed geographically as follows: 6,000,000 h.p. in the Columbia drainage; 7,300,000 h.p. in the Fraser basin; 1,300,000 h.p. in the Peace River drainage near Prince George; and 500,000 h.p. in the coastal areas. All of the Columbia and Peace River potential, 3,600,000 h.p. of the Fraser River potential and part of the coastal potential could be developed without damaging the salmon resources. There exists, therefore, a tremendous block of undeveloped water power which can be made available by modern transmission systems for the industrial needs of the area for many years into the future without endangering the future of the Fraser salmon resources. It appears that no localized area need be denied the power required for industrial growth because of the need to protect the fisheries resource.

Examples of current developments or proposals for development of hydro-electric power in the Fraser basin where the fish problem need not be serious are found in the Nechako project, under construction by the Aluminum Company of Canada, and the north fork of the Quesnel River project, being proposed by the Government of British Columbia. The Nechako project was chosen in preference to the Chilko River development since the latter development would have destroyed the sockeye runs. By provision of minor fish protective facilities in connection with the Nechako project little or no damage to the sockeye runs would result from the development of approximately 2,000,000 h.p. of electrical energy. The north fork of the Quesnel development has been chosen in preference to a development on the main Quesnel River to supply the growing power needs of central and northern British Columbia. The selection of these power sites is an example of how industry and natural resource development can be harmonized to the economic benefit of the region. There are many other examples of such developments for future consideration.

The current principle of selecting power sites which need not damage salmon resources has two advantages. Both advantages lie in the time delay in the development of damaging power sites. Some new source of energy may eventually nullify the need for such developments. The second advantage is the time given for finding methods for successfully passing migrant salmon, both fingerlings and adults, past structures which would now act as exterminators of such fish populations. Since a practical substitute source of energy might not be obtainable it is absolutely essential

that methods be devised if possible for passing migrant salmon over high dams if the salmon resources of the Fraser River are to be preserved in perpetuity. The technical men are accepting the challenge of developing substitute sources of energy and they also are accepting the challenge of finding a method of passing salmon over high dams. Success in either case should preserve the salmon of the Fraser River. Failure in both cases would mean the eventual destruction of another great food resource in a starving world. Time is essential to the solution of the power-fish problem if the problem must be created by necessity. The provision of the required time appears to be economically feasible without delaying or restricting the economic growth of the Fraser River basin.

The investment in the scientific effort of restoring the Fraser sockeye runs is already paying high dividends and the project obviously warrants continued attention. It should be possible, with adequate research and effective co-operation, to solve the few problems which may arise in future years to threaten the perpetuation of the fisheries resource.

COMMISSION MEETINGS

The *first* of the 1952 series of Commission meetings was convened at Seattle, Washington, on January 29 and 30. The problem of maintaining the sockeye populations in the Nechako system after the closure of the Alcan dam was thoroughly discussed, and the Director was instructed to co-operate with the Federal Department of Fisheries in the preparation of a supplementary report relating particularly to the specific problem of water temperature control. A progress report on investigations relating to the cause and extent of mortality of downstream migrant sockeye at dams was presented to the Commission by the staff. Upon discussion of the current program of artificial rehabilitation it was agreed that where sufficient remnant stocks of native runs are available for rehabilitation no artificial transplants of sockeye will be undertaken.

The Commission requested a review of the 1951 sockeye fishing season regarding the catch and spawning escapement as a matter of information to the Advisory Committee. The problems of regulating the 1952 fishery were also discussed with the Advisory Committee, and after due consideration the recommendations for regulations covering the current year were approved for submission to the Governments of Canada and the United States.

In accordance with established precedent, the election of officers to conduct the affairs of the Commission for the ensuing two years was concluded with Robert J. Schoettler being elected Chairman and A. J. Whitmore, Secretary. The retention of Milo C. Bell as a part-time engineering consultant was approved.

Members of the Advisory Committee which met with the Commission on January 30 were Peter Jenewein, gillnet fishermen; M. W. Black, sport

fishermen; and Richard Nelson, salmon packers representing Canada, and Chester Karlson, gillnet fishermen; N. Mladinich, purse seine fishermen; J. R. Brown, troll fishermen; and J. N. Planich, salmon packers representing the United States.

The *second* meeting of the year was held in Ottawa on June 2 and in Washington, D.C. on June 4 and 5. The primary purpose of this meeting was to discuss and consider administrative problems with representatives of the Governments of Canada and the United States. In fixing the time and place of this regular spring meeting the Commission followed the established policy of meeting in the capital cities of the two countries at least once every two years. In Ottawa the principal subject under discussion was the collaboration of the Commission's staff with the Department of Fisheries on investigations relating to mutual problems created by the growing industrial expansion within the Fraser River watershed. The discussion of investigations of this type included downstream migrant studies, the construction of the Alberta-Vancouver oil line, industrial pollution, potential hydro-electric developments and the diversion of the Nechako River by the Aluminum Company of Canada for power development on the Coast of British Columbia.

In Washington, D.C., the Commission presented a complete resume of its current operations and of the administrative difficulties arising therefrom. Representations were made to the Bureau of the Budget after the 1953-54 budget submission had been considered and approved.

A *special* meeting was held in Bellingham, Washington, on July 24 to consider the need for any modification in the regulations governing the 1952 fishing season. A twenty-four hour extension in the weekly fishing period on the Fraser River, ending at 8:00 a.m. July 25, was approved in order to allow adequate exploitation of races which would otherwise have had excessive escapements from either the beginning or end of their migrations. Mr. H. R. MacMillan, C.B.E., D.Sc., was welcomed as a new Commissioner representing Canada and replacing the late Olof Hanson.

Four Commissioners gathered at the Quesnel Field Station on September 27, 28 and 29 to examine the field operations of the staff and to inspect conditions on several of the principal spawning areas which are undergoing rapid rehabilitation.

The *fourth*, and last official meeting of the year was held in Bellingham Washington, on November 20 and 21. Among the many items of business conducted was the appointment of Mr. Morgan Berg as a Canadian representative of the salmon troll fishermen on the Advisory Committee, replacing Andrew E. Carr, resigned.

Several reports on the scientific investigations conducted by the Commission's staff were presented to the Advisory Committee and interested visitors. After an extensive review of the 1952 sockeye catch and escapement the staff proposals for regulating the 1953 sockeye season were presented,

with underlying justifications, to the Commission and its Advisory Committee by the Director.

The members of the Advisory Committee attending the meeting on November 21 were W. J. Pitre, purse seine fishermen; Peter Jenewein, gillnet fishermen; Richard Nelson, salmon packers; M. W. Black, sport fishemen; and Morgan Berg, troll fishermen representing Canada, and N. Mladinich, purse seine fishermen; Chester Karlson, gillnet fishermen; J. N. Planich, salmon packers; and John Brown, troll fishermen representing the United States.

1952 REGULATIONS

Recommendations for regulations governing the management of the sockeye fishery in 1952 were considered and adopted at a meeting of the Commission held with its Advisory Committee in Seattle, Washington, on January 30, 1952.

The recommendations for regulations, as approved by the Commission, were transmitted to the Departments of Fisheries of Canada and of the State of Washington and to the Secretary of the Interior at Washington, D.C. The recommendations were accepted in substance for Canadian waters by an Order-in-Council adopted on June 6, 1952, and for United States waters by an Order of the Director of the Washington State Department of Fisheries promulgated May 23, 1952.

The recommendations of the Commission were as follows:

Canadian Convention Waters

The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention relating to the protection, preservation, and extension of the Sockeye Salmon Fisheries between the United States of America and Canada, signed at Washington on the twenty-sixth day of May, 1930, hereby recommends to the Honourable the Minister of Fisheries that regulations to the following effect, in the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia, for the Season of 1952, under authority of the Fisheries Act, namely:

1. That in the waters of Canada embraced in Article I of the Convention relating to the protection, preservation, and extension of the Sockeye Salmon Fisheries between the United States of America and Canada, signed at Washington on the twenty-sixth day of May, 1930, the season for fishing for sockeye salmon shall commence at 12:01 a.m. on the thirtieth day of June, 1952.

2. That in the waters of Canada embraced in Paragraph 1 of Article I of the said Convention and known as Areas 21 and 23 of District 3 the season for fishing for sockeye salmon shall cease, in so far as the recommendations of this Commission shall apply, at 12 midnight on the tenth day of August, 1952.

3. That in the waters of Canada embraced in Paragraph 2 of Article I of the said Convention and known as Areas 19 and 20 of District 3 the season for fishing for sockeye salmon shall cease, in so far as the recommendations of this Commission shall apply, at 6:00 p.m., on the twenty-fourth day of August, 1952.

4. That in the waters of Canada embraced in Paragraphs 2 and 3 of Article I of the said Convention and known as District 1 and Areas 17 and 18 of District 3 the season for fishing for sockeye salmon shall cease, in so far as the recommendations of this Commission shall apply, at 8:00 a.m., on the twenty-ninth day of September, 1952.

5. That in the waters of Canada embraced in Paragraphs 1 and 2 of Article I of the said Convention and known as Areas 19, 20, 21 and 23 of District 3 there shall be a weekly closed period of forty-eight hours duration. This weekly closed period shall commence for Gill Nets and Traps at 6:00 p.m. Friday of each week and shall continue until 6:00 p.m. Sunday following; for Purse Seines the weekly closed period shall commence at 12:01 a.m. Saturday of each week and continue until 12:01 a.m. Monday following.

6. That in the waters of Canada embraced in Paragraphs 2 and 3 of Article I of the said Convention and known as District 1 and Areas 17 and 18 of District 3 there shall be a weekly closed period of 72 hours duration which shall be according to the following schedule:

> The weekly closed period in Areas 17 and 18 for Purse Seines shall commence at 12:01 a.m. Friday of each week and continue until 12:01 a.m. Monday following.
>
> The weekly closed period in Area 18 for Gill Nets shall commence at 6:00 p.m. Thursday of each week and continue until 6:00 p.m. Sunday following.
>
> The weekly closed period for Gill Nets in Area 17 and that part of District 1 below Pattullo Bridge at New Westminster shall commence at 8:00 a.m. Friday of each week and continue until 8:00 a.m. Monday following.
>
> The weekly closed period in District 1 above Pattullo Bridge at New Westminster shall be of seventy-six hours duration and shall commence at 8:00 a.m. Friday of each week and continue until 12 noon Monday following.

7. That in the waters of Canada embraced in Paragraphs 2 and 3 of the said Convention and known as District 1 and Area 17 of District 3 the weekly closed period of seventy-six hours duration above Pattullo Bridge at New Westminster and seventy-two hours duration below Pattullo Bridge at New Westminster as set forth in Item 6 of these recommendations shall also apply to the weekend immediately preceding June 30, 1952.

8. The Commission recommends that consideration be given to representations which may be made from time to time by the Commission, through its Chairman, to the Chief Supervisor of Fisheries for British Columbia respecting modification of the weekly closed period or additional closed periods for fishing for sockeye salmon.

9. That in the waters of Canada embraced in Article I of the said Convention no one shall buy, sell, or have in his possession any sockeye

Table I
SOCKEYE CATCH BY GEAR

United States Treaty Waters

	Purse Seines		Gill Nets		Reef Nets		
	Units	Catch	Units	Catch	Units	Catch	Total
1940	140	515,912	82	57,965	69	80,219	654,096
1944	60	335,172	55	40,625	40	59,651	435,448
1948	195	940,409	151	70,991	87	77,656	1,089,056
1952	210	826,304	192	175,064	81	112,107	1,113,475

Canadian Treaty Waters

	Traps	Purse Seines	Gill Nets	Total
1940	28,756	0	1,004,244	1,033,000
1944	29,224	0	974,602	1,003,826
1948	74,545	14,511	663,635	752,691
1952	65,417	122,114	966,852	1,154,383

Table II
LANDINGS AND PACK OF SOCKEYE 1946–1952

	United States	Canada	Total
*1952			
Total Landings (No. Sockeye)	1,113,475	1,154,383	2,267,858
Share in Fish	49.10%	50.90%	
Total Pack (48 lb. cases)	114,638	115,814	230,452
Share in Pack	49.74%	50.26%	
1948			
Total Landings (No. Sockeye)	1,089,056	752,691	1,841,747
Share in Fish	59.13%	40.87%	
Total Pack (48 lb. cases)	90,441	61,650	152,091
Share in Pack	59.46%	40.54%	
1946–1952 (7 year totals)			
Total Landings (No. Sockeye)	9,256,998	9,704,858	18,961,856
Share in Fish	48.82%	51.18%	
Total Pack (48 lb. cases)	807,013	834,465	1,641,478
Share in Pack	49.16%	51.84%	
1952 Pack	114,638	115,814	230,452
1948 "	90,441	61,650	152,091
1944 "	37,379	88,150	125,529
1940 "	59,354	93,361	152,715
1936 "	59,505	184,854	244,359†
1932 "	81,188	65,769	146,957
1928 "	61,044	29,299	90,343
1924 "	69,369	39,743	109,112
1920 "	62,654	48,399	111,053
1916 "	84,637	32,146	116,783
1912 "	184,680	123,879	308,559

* 12 Canneries in the United States and 11 canneries in Canada received the sockeye caught in Convention waters.

† Includes 16,609 cases from sockeye caught in Johnstone Straits. Sockeye taken in Convention waters only are included in pack figures listed for years after 1936.

salmon taken by any gear during the times when fishing for or taking sockeye salmon is prohibited in such waters.

10. Nothing contained in any Regulations made pursuant to the Fisheries Act shall apply to the taking of sockeye salmon in the waters of Canada embraced in Article I of the said Convention by the International Pacific Salmon Fisheries Commission or its servants or duly authorized agents acting pursuant to its directions for the purpose of exercising its objects under the said Convention.

Two modifications were made in the 1952 regulations governing sockeye fishing in Canadian Convention waters as approved by the Order-in-Council referred to above. Because of a "Tie-up" in the Canadian fishing fleet on July 21, 22, 23 and up to 6:00 p.m. on July 24, the regular weekly fishing period in District 1 (Fraser River) was extended 24 hours, to 8:00 a.m. Saturday, July 26. The purpose of this extension of fishing time in District 1 of Canadian waters was to allow adequate exploitation of sockeye races which would otherwise have had excessively large escapements from the beginning and end of their migrations. The character of such escapements was not considered desirable for maximum reproduction.

A second emergency modification consisted of extending the normal weekend closed season in the first week of August by twenty-four hours in all Canadian waters. The purpose of this extension in the weekly closed period at that time was to obtain the desired escapement of Chilko sockeye and to aid in dividing the catch as near as practicable between the fishermen of Canada and of the United States. No further modifications in the 1952 regulations were required for Canadian Convention waters, although a strike of all Canadian fishermen occurred from September 6 to October 20, and no sockeye were landed during this period.

United States Convention Waters

The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention relating to the protection, preservation, and extension of the Sockeye Salmon Fisheries between the United States of America and Canada, signed at Washington on the twenty-sixth day of May, 1930, hereby recommends to the Director of Fisheries of the State of Washington that regulations to the following effect, in the interests of such fisheries, be adopted by him by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. That in the waters of the United States of America embraced in Article I of the Convention relating to the protection, preservation, and extension of the Sockeye Salmon Fisheries between the United States of America and Canada, signed at Washington on the twenty-sixth day of May, 1930 the season for fishing for sockeye salmon shall commence at 12:01 a.m. on the thirtieth day of June, 1952.

2. That in the waters of the United States of America embraced in Article I of the said Convention the season for fishing for sockeye

Table III

DAILY CATCH OF SOCKEYE 1940–1944–1948–1952 FROM UNITED STATES TREATY WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1940	1944	1948	1952	1940	1944	1948	1952	1940	1944	1948	1952
1	31			5,011	48,139	58,863	118,062	40,805	1,063	26	2,707	714
2				8,640	47,299	46,797	100,423		199		391	598
3	26	4		7,943		28,550	97,469		329	49	1,150	433
4	1			4,857	29,215	20,117	67,360	32,815	507	44		435
5	18				36,386		60,700	25,891	805	65	1,297	140
6		7			57,375	9,370	68,962	16,978	419	55	3,799	
7		65		14,008	31,172	6,912		18,488		19	1,692	723
8	3			9,369	29,493	9,221	115,925	13,920	93	6	404	203
9	32	178		8,090	22,432	3,859	101,997		131		333	578
10	49	163		6,796		3,144	38,878		170	21	134	636
11	76	93	CLOSED	4,187	8,288	5,783	17,297	6,865	257	39		557
12	197	105			3,219			7,055	287	6	212	410
13		160			4,652	1,890		2,697	138		205	
14	2,004	242		9,159	4,764	2,262		2,712		20	65	434
15	7,150			10,812	7,972	366		2,831	305	2	15	299
16	3,750	1,393		13,794	3,329	1,234			203		42	272
17	8,016	1,289		16,876	380	935			187	28	140	193
18	14,083	2,660	1,900	11,786	1,717	423		4,096	463	28		202
19	15,731	3,640	2,469		3,057			3,143	175	3	193	151
20		8,985	6,348		1,235	1,395		2,730	93	5	88	
21	28,841	8,187	8,622	90,696	332	1,612		967		17	20	117
22	22,295		5,671	32,619	88	222		612	116	4	24	135
23	13,150	11,780	5,142	34,320	95	74			128		11	86
24	24,060	14,483		110,491		9			55	6	16	49
25	22,405	11,483	17,524	134,294	617	75		220	58	1		48
26	24,248	17,767	22,251		26			720	15	1	16	34
27		25,746	23,441		179	51		1,168	10	1	22	
28	19,645	18,884	42,887	128,339	283	150		1,310		1	429	20
29	19,763		69,529	100,767	866	243		931	60		811	20
30	34,775	46,468	78,843	96,565	466	192			18		319	31
31	43,488	57,453		56,664		17		655				
Totals	303,837	231,235	284,627	916,083	343,076	203,766	787,073	187,609	6,284	447	14,535	7,518
June Total	5			2,134								
Balance of Season Total									894		2,821	131
Season Total									654,096	435,448	1,089,056	1,113,475

TABLE IV

DAILY CATCH OF SOCKEYE, 1940–1944–1948–1952 FROM CANADIAN TREATY WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1940	1944	1948	1952	1940	1944	1948	1952	1940	1944	1948	1952
1	126			10,225	30,779	98,603		11,392			2,149	13,562
2	142			8,532	1,132	91,273	62,634		4,880		2,772	5,599
3	197	218		12,241		89,969	54,876		2,474			3,343
4	409	228		1,184		69,713	58,060	811	2,134	1,813		6,475
5	526	328			119,969		74,788	108,955	1,011	1,834		
6		396			44,468		18,427	36,472	983	2,689	2,830	
7		711		13,476	40,894	85,516		23,048		1,714	1,028	
8	2,680			10,009	50,380	31,746		911			388	
9	2,348			8,732	438	34,491	101,965		1,337		396	
10	2,980	1,852		9,000		24,922	62,668		1,003			
11	4,103	1,360		1,317		22,513	39,454	38,878	434	458		
12	6,249	1,572	CLOSED		19,920		35,812	12,321	772	413		
13		2,286			11,063		1,645	11,433		284	1,927	
14		2,868		13,063	9,428	12,203		9,381		576	1,437	
15	15,718			8,249	7,448	5,933		110			1,663	STRIKE
16	10,262			13,221	9,507	8,641	30,941		1,621		1,792	
17	13,403	5,119		22,896		8,117	24,102		610			
18	14,781	5,722		11,729		9,424	13,438	17,786	519	3,018		
19	15,465	5,486	1,281		22,711		11,021	9,714	640	3,175		
20		5,058	1,281		6,814		107	6,218		1,567	3,117	
21		13,961	1,283	5,299	7,872	16,981		5,510		1,226	931	
22	38,682		637	5,299	7,353	4,696					703	
23	29,119			5,299	6,804	3,290	15,618		9,722		859	
24	33,497	45,821		39,207		2,615	8,322		4,175			
25	35,661	22,035		48,841			8,302	21,489	2,053	5,574		
26	1,584	18,488	2,912		5,479		7,505	9,583	1,938	1,232		
27		15,723	2,967		2,904		104	6,535		488	5,523	
28		12,229	16,769	211,103	1,754	9,138		5,175		704	3,130	
29	83,941		11,248	109,483	785	1,632					2,216	
30	33,749		23,567	79,096	1,200	1,275	2,241		3,365		1,650	
31	26,553	170,205		120,159		936	1,623					
Totals	372,175	331,666	61,945	767,660	409,102	633,627	633,653	335,722	39,671	26,765	34,511	28,979
May & June Totals	1,062	529	879	15,386								
Balance of Sept. Oct. & Nov. Totals									63,899	11,239	21,703	178 6,458
Unassigned as to date of catch									147,091			
Season Total									1,033,000	1,003,826	752,691	1,154,383

salmon shall cease, in so far as the recommendations of this Commission shall apply, at 6:00 p.m. on the twenty-fourth day of August, 1952.

3. That in the waters of the United States of America embraced in Article I of the said Convention there shall be a weekly closed period for all gear of not less than forty-eight hours duration. This closure shall be according to the following schedule:

That the weekly closed period for Purse Seines and Reef Nets shall commence at 12:01 a.m. Saturday of each week and continue until 12:01 a.m. Monday following.

That the weekly closed period for Gill Nets shall commence at 6:00 p.m. Friday of each week, and continue until 6 p.m. Sunday following.

4. That in the waters of the United States of America embraced in Article I of the said Convention no one shall buy, sell, or have in his possession any sockeye salmon taken by any gear during the times when fishing for or taking sockeye salmon is prohibited in such waters.

5. That consideration be given to representations which may be made from time to time by the Commission, through its Chairman, to the Director of Fisheries of the State of Washington respecting additional closed time for fishing for sockeye salmon.

6. Nothing contained in any rules or regulations relating to fishing for or taking of sockeye salmon shall apply to the taking of sockeye salmon within the waters of the United States of America embraced in Article I of the said Convention by the International Pacific Salmon Fisheries Commission or its servants or agents acting pursuant to its directions for the purpose of exercising its objects under the said Convention.

The above approved regulations were in effect throughout the sockeye fishing season and no modifications were required.

High Seas

Under the authority of the Convention hereinafter mentioned, the International Pacific Salmon Fisheries Commission at its meeting in Seattle, Washington, on the thirtieth day of January 1952, made and adopted the following order and regulation, namely:

"taking Sockeye Salmon on the High Seas described in paragraph numbered 1 of ARTICLE I of the Convention between the United States of America and the Dominion of Canada for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, is hereby prohibited from midnight Friday to midnight Sunday during each weekly period between June 30th and August 10th, both dates inclusive in the year 1952; provided that this order and regulation shall apply only to nationals and inhabitants and vessels and boats of the United States of America and the Dominion of Canada: this Order and Regulation being affirmatively voted by three of the Commissioners of the United States of America and three of the Commissioners of the Dominion of Canada."

Patrol agencies of both the United States and Canada provided adequate vessels and officers for the enforcement of the high seas regulation protecting the Fraser River sockeye. The *Crane* was transferred by the U.S. Fish and Wildlife Service from its Alaska operations to the enforcement of sockeye regulations on the high seas. The Canadian Department of Fisheries had one or more vessels assigned to the same patrol whenever required. Co-operation between patrol agencies and the fishermen was excellent and no violations were reported in this area.

THE UNITED STATES FISHERY

Early season fishing in Puget Sound commenced with a fleet of about 135 purse seine boats, 130 gillnet boats and 45 reef nets. This fishing fleet was later expanded to the maximum number as shown in Table I. Fishing intensity increased only slightly as compared with the substantial increase in intensity occurring in the preceding years. The lack of the usual increase in fishing intensity made it possible for the United States fishing fleet to take the desired percentage of the total run (35 percent) without modification in the regulations.

Early July and August catches were in accordance with pre-season anticipations but the timing of the Chilko run, which normally peaks on July 31 and August 1 shifted five days earlier in 1952. This shift in timing caused the Chilko run to enter the United States fishery earlier than for any year since the beginning of daily records in 1935. The 1952 pack of sockeye taken in Puget Sound exceeded that of any previous cyclic year since 1912. The fish averaged unusually large throughout the season and the average weight of the fish comprising the total catch is expected to equal or exceed that for any previous year in the history of the Fraser sockeye fishery.

The daily sockeye catches in United States waters are recorded in Table III for the years 1940, 1944, 1948 and 1952. Table II lists the total landings and pack of sockeye for the 1952 season as compared with that of the preceding cyclic years. It also includes the total catch since the Commission commenced controls over the fishery.

The rehabilitation of the early season runs combined with the higher efficiency of nylon gillnets has greatly increased the percentage of the total run taken by gillnets. This increase in the number of sockeye taken by gillnets is evident in Table I.

THE CANADIAN FISHERY

The normally high efficiency of the Canadian gillnet fleet in fishing this cyclic run was re-established in 1952. The great drop in the fishing efficiency in 1948 when Canada failed to take its share of the allowable catch remains unexplained. Since 1948 was the only year when the catch in this cycle

TABLE V

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1948, 1952

	1948		1952	
District and Area	*Catch*	*No. of Fishermen*	*Catch*	*No. of Fishermen*
HARRISON-BIRKENHEAD				
Skookumchuck	—	—	1,686	10
Lillooet Lake	—	—	—	—
Birkenhead River	3,781	—	9,679	29
TOTALS	3,781		11,365	39
LOWER FRASER				
Laidlaw to Vedder River			2,545	
Seabird Island	—			
Katz and Ruby Creek	1,009	3	6,310	
TOTALS	1,009	3	8,855	
CANYON				
Union and American Bars	—	—	806	
Yale	4,632	13	4,979	
Spuzzum	251	2	961	
Lower Gorge	356	2	—	
Upper Gorge	591	3	—	
Boston Bar	—	—	1,331	
Boothroyd	2,442	6	1,441	
Cisco	4,417	15	3,522	
TOTALS	12,689	41	13,040	
LYTTON-LILLOOET	18,157	18	6,674	49*
Gates Creek	—	—	2,000	
TOTALS	18,157	18	8,674	49*
BRIDGE RIVER RAPIDS				
Lillooet	10,028	24	4,314	37
Rapids	16,357	28	10,337	51
Pavillion	1,518	4	4,154	19
TOTALS	27,903	56	18,805	107*
CHILCOTIN				
Farwell Canyon	1,862	9	2,056	
Hance's Canyon	4,248	10	3,391	
Martins	—	—	11	
Anahim	—	—	—	
Alexis Creek	4,979	30	2,361	
Siwash Bridge	—	—	4,330	
Keighley Holes	6,499	16	—	
Henry's Crossing	—	—	—	
TOTALS	17,588	65	12,149	72*
UPPER FRASER				
Shelly	480	7	232	
Alkali Creek	50	25	550	
Chimney Creek	500	31	1,808	
Soda Creek	550	19	365	
Alexandria	175	9	145	
Quesnel	350	6	385	
TOTALS	2,105	97	3,485	89*
NECHAKO				
Nautley Reserve	480	7	942	10
Stella Reserve	625	8	1,242	16
TOTALS	1,105	15	2,184	26
STUART LAKE				
Fort St. James	600	14	1,946	35
Tachie Reserve	400	10	1,162	21
Trembleur and Takla Lake	50	2	113	2
TOTALS	1,050	26	3,221	58
THOMPSON				
Nicomen Creek	—	—	1,157	
Ashcroft	300	—	—	
Deadman's Creek	—	—	—	
North Thompson River	250	—	—	
South Thompson River	500	—	1,568	
TOTALS	1,050	—	2,725	
GRAND TOTALS	86,437		84,503	

* Number of permits issued to Indians in District.

The Indian Catch statistics detailed above are obtained principally from the Fisheries Inspectors of the Canadian Department of Fisheries. These inspectors control the taking of sockeye for food by the various Indian populations residing throughout the Fraser River Watershed.

was abnormally low a return to normal efficiency was expected in 1952. If the July 21-24 tie-up and the September 6 to October 20 strike had not occurred extra closed days would have been necessary in addition to the emergency closure on August 4 to provide the required escapement and to accomplish equal division of the allowable catch. Under the circumstances the escapement was adequate and only one closed day was necessary to bring the catch by the fishermen of the two countries to equality.

The purse seine fishery in Areas 20-23 was unusually effective during the few days that it operated. An estimated 35 boats caught 10.6 percent of the total Canadian catch of sockeye. The trap catch was lower than that of the preceding cyclic year.

ESCAPEMENT

The total calculated escapement of 852,084 sockeye in the Fraser River system during 1952 represents 27 percent of the total run (Table VI). This is a substantial increase in the percentage of escapement of the exploited races over that of recent years for which an average of slightly less than 20 percent has been recorded. The increase in the ratio of escapement to catch over that of the preceding three years was the result of the "tie-up" on July 21, 22 and 23, the emergency closure on August 4, and the Fall strike beginning September 6 and extending to October 20, all of which were operative in Canadian waters only. In spite of the record size of the year's run and the periodic cessation of fishing in Canadian waters, the total escapement was less than that recorded in 1948, the previous cycle-year. However, the escapement in 1948 represented 32 percent of the run, and two-thirds of the escapement that year spawned in Chilko River. The 1952 escapement was distributed more evenly throughout the watershed, better adjusted to the spawning limitations of certain areas, and in general appeared more satsifactory from the standpoint of reproduction than did the larger 1948 escapement.

The spawning runs to three areas are particulary noteworthy. In the Horsefly River, the major spawning ground of the Quesnel district, 6829 three-year sockeye, including a few females, were counted. The presence of this large number of "jack" sockeye tends to further support the belief that the 1953 Horsefly run entering the fishery may possibly total several hundred thousand sockeye. In addition to the run of three-year-old fish, which will aid in providing for an increased population in this formerly barren cycle, there were 184 four-year-old sockeye observed on the spawning grounds mixed in with the smaller three-year-old fish.

Since the construction of the Bridge River Rapids fishways in the spring of 1946 few sockeye have been observed in the Seton-Anderson system. No observations were made by the Commission's staff in that district during 1948, but Federal fishery guardians reported that a few pairs of spawning sockeye were present that year in Gates Creek at the upper end of Anderson Lake. A surprisingly large run, calculated to be 6883 individuals, was

found spawning in Gates Creek during the 1952 season. In addition to the number observed spawning, it was estimated that two thousand fish were captured for food by Indians living adjacent to the Creek. As is the case with all other sockeye spawning populations the newly rehabilitated Gates Creek run was timed with the water temperature cycle, and by reason of its late August spawning period it is a new addition to the mid-summer runs of the 1952 cycle.

Although there are no historical records of sockeye spawning in or near Taseko Lake at the headwaters of the Taseko or Whitewater River, a few hundred sockeye have in recent years been observed spawning on the shore of Taseko Lake. It is extremely difficult to observe spawning sockeye in this area because of the suspended glacial silt in both the lake and the outflowing river. Extensive tagging operations were conducted this year, and a total spawning population of 3647 sockeye was calculated for the area. From the air this rather sizeable lake looks almost like a glacial mud-hole yet it is obvious that it is capable of producing a sockeye run. Only time will show what numbers of sockeye can be produced in this alpine and highly glacial area lying at an altitude of 4400 feet above sea level.

Spawning populations in the Fraser-Francois and the Stuart Lake systems increased substantially over the previous cycle-years. It should be noted, however, that the Driftwood and Middle Rivers continue to remain practically barren of spawning adult sockeye on this cycle. The escapement to the Bowron River was slightly less than that of the previous cycle, and it would have been substantially less than the escapement of 1948 if the "tie-up" had not occurred in Canadian waters on July 21, 22 and 23. It becomes increasingly obvious that the escapements in recent years have been greater than this area requires for maximum production. The Bowron is one of the few districts in the Fraser watershed where the sockeye spawning area appears to be far in excess of that required to meet the rearing limitations of the related lake area.

On the basis of present knowledge the number of sockeye spawning at the outlet of Chilko Lake in 1952 is considered to be close to the optimum number for this area. Studies in 1948 indicated that a population of 670,000 spawners created so much competition for space among individuals that many sockeye spawned in undesirable areas. In that year over 100,000 sockeye were forced to spawn in shallow gravel beds which became exposed by receding water in the winter and were frozen. While some crowding was observed in 1952 with 490,000 fish on the spawning beds, the distribution of spawners was considered to be much more satisfactory than that observed in 1948.

The early run of sockeye through the Thompson River to the Raft River spawning grounds and to the Seymour River spawning grounds was substantially larger than in 1948. The escapement to the Raft River was the largest ever recorded by Commission observers. In spite of the extended

Table VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1940, 1944, 1948, 1952

District and Stream	Period of Peak Spawning	Estimated Number of Sockeye				3-yr. Jacks	Sex Ratio	
		1940	1944	1948	1952		Males 4-5 yr.	Females 4-5 yr.
Lower Fraser								
Cultus Lake	Nov. 23-Dec. 1	74,121	14,200	13,086	18,910	1,077	5,698	12,135
Upper Pitt	Sept. 8-13	P*	P*	53,000	48,887	0	24,252	24,635
Widgeon Slough	Nov. 15-20		1,050		1,648	141	551	956
Harrison								
Big Silver Creek	Sept. 14-16	5,149	5,192	12,000	6,031	9	3,215	2,807
Douglas Creek	Sept. 14-16	337	36	350	200		100	100
East Creek		28	65	45	Dry			
Harrison River	Nov. 13-18	11,000	73	26,000	25,794	0	8,550	17,244
Hatchery Creek		400	63	150	Dry			
Weaver Creek	Oct. 28-30	17,600	16,441	20,000	33,983	50	15,344	18,589
Lillooet								
Birkenhead River	Sept. 25-30	27,320	57,707	120,000	79,082	23,813	23,890	31,379
Seton-Anderson								
Gates Creek	Aug. 26-Sept. 1				6,883	0	3,261	3,622
South Thompson								
Seymour River	Aug. 19-21	600	200	4,000	6,785	491	3,083	3,211
Lower Adams River	Oct. 14-16	9,900	1,367	12,600	8,692	2,563	2,375	3,754
Little River	Oct. 10-17	1,700	200	2,400	1,964	864	570	530
Scotch Creek	Aug. 24-25	0	0	50	357	344	2	11
South Thompson River	Oct. 10-17	100	0	100	200	55	63	82
North Thompson								
Raft River	Aug. 24-28	11,400	1,082	10,500	15,819	0	7,446	8,373
Chilcotin								
Chilko River	Sept. 21-23	300,000	328,655	670,000	489,473	2,544	231,364	255,565
Taseko Lake	Sept. 6-9			P*	3,647	0	1,715	1,932
Quesnel								
Horsefly River	Aug. 26-Sept. 3	90	3	50	7,013	6,829	92	92
Little Horsefly River			2	0	2	2	0	0
Mitchell River		**	**	0	1	1	0	0
Nechako								
Endako River	Sept. 3-5	8	1	0	146	36	55	55
Nadina River	Aug. 23-28	**	**	30	1,677	645	549	483
Nithi River				1	45	16	15	14
Ormonde Creek	Aug. 23-27	36	15	150	996	75	369	552
Stellako River	Sept. 26-30	2,600	3,294	16,000	40,462	85	19,865	20,512
Stuart Lake								
Driftwood River		**	**	**	38	36	0	2
Forfar Creek	Aug. 2-6	90	46	1,500	6,975	489	3,287	3,199
Gluske Creek	Aug. 1-6	0	**	1,500	5,911	339	2,752	2,820
Kazchek Creek		10	3	80	295	284	11	0
Kynoch Creek	Aug. 1-5	195	350	7,500	13,439	475	6,404	6,560
Middle River		300	22	200	476	466	10	
Narrows Creek	Aug. 11-15	5	0	0	1,453	697	378	378
Rossette Creek	July 31-Aug. 5	0	2	1,500	3,575	205	1,665	1,705
Shale Creek	Aug. 11-15	**	**	0	414	225	94	95
Tachie River		**	**	20	364	362	2	0
5 Mile Creek	Aug. 11-15	**	**	**	50	0	25	25
Forsythe Creek	Aug. 11-15	**	**	**	38	16	11	11
Frypan Creek	Aug. 11-15	**	**	**	86	9	38	39
Leo Creek	Aug. 11-15	**	**	**	16	16	**	**
25 Mile Creek	Aug. 11-15	**	**	**	248	70	89	89
Ankwil Creek	Aug. 11-15	**	**	**	240	67	86	87
Dust Creek	Aug. 11-15	**	**	**	867	610	128	129
Crow Creek	Aug. 11-15	**	**	**	71	58	6	7
15 Mile Creek	Aug. 11-15	**	**	**	50	0	25	25
Sakeniche River	Aug. 25-30	**	**	**	76	38	19	19
Bivouac Creek	Aug. 1-6				33	20	6	7
Northeast								
Upper Bowron River	Aug. 25-Sept. 5	4,625	1,700	25,218	18,672	27	8,940	9,705
Totals		467,614	431,769	998,030	852,084	44,149	376,400	431,535

** —No observations made.
P* —Present but not counted.

strike by the Canadian fishermen during the period of migration of the late run to Lower Adams River the escapement to the Lower Adams did not equal that of the previous cycle. This small escapement to Lower Adams River reveals once again that the factor or factors controlling quadrennial dominance in productivity in the reproducing areas above Hell's Gate may perhaps be of greater importance than the size of the escapement. The almost complete failures of the runs recorded consistently cycle after cycle for two years out of every four even before the advent of commercial fishing indicates that low productivity in the "off years" is a naturally established phenomenon.

Escapements to the lower river spawning areas were normal in some cases, but increases were shown where the effect of the fishery was reduced by the Fall strike. The escapement to the important Birkenhead River spawning area declined significantly for the second year in succession. Flood control work carried out in 1947 involving channel changes in the major spawning area has caused a definite shift in the location of sockeye spawning. Since sockeye appear to have an ability for selecting the most productive areas for depositing their eggs this shift in spawning grounds has probably resulted in a lower level of productivity. However, such a decline in productivity would be difficult to establish without extensive and time consuming investigations.

THE 1953 CYCLE

Sockeye catches in 1953 will originate principally from races which were almost extinct eight years or two cycles ago. The Chilko race has obviously been the mainstay of this cycle since 1913, even though it was seriously affected by the Hell's Gate slide. A record Chilko run appeared in 1941 only to encounter a very serious block at the Gate. It was estimated that hundreds of thousands of fish failed to pass the obstruction, and it is obvious now that the reproductive capacity of the 280,000 sockeye which reached Chilko was seriously impaired. The next largest annual run, occurring the preceding year (1940), was not so seriously injured.

After 1941 while production on the 1941 cycle continued to drop the 1940 cycle continued to produce at a substantial rate. True dominance in the annual runs to Chilko now appears to be on the 1940 or 1952 cycle, and the run to Chilko on the 1941 or 1953 cycle, the original cycle of dominant productivity, will now be of minor importance. Counts of seaward migrants from the 1949 spawning indicate that the run in 1953 may be smaller than the run in 1949, the preceding cycle-year. Concurrent with the declining productivity in the 1941 Chilko cyclic run and the increasing production on the 1940 cycle there has been a decided increase in the 1939 cyclic production. The 1939 cycle has been a cycle of low productivity since the earliest records. However, by 1951, twelve years or three cycles later, the run contained approximately 600,000 fish of which 118,000 escaped to the spawning grounds. Thus the two years of high productivity at Chilko have occurred in 1951 and

FIGURE 2. Primitive Indian weir for taking sockeye in the Stuart River at Fort St. James, B. C., near the outlet of Stuart Lake. This picture was taken about 1890 and is furnished as a courtesy to the International Pacific Salmon Fisheries Commission by the Hudson's Bay Company

1952, one cyclic year earlier than the previously recorded years of high productivity.

Spawning Area	*Escapement in Numbers of Sockeye*	
	1941	1949
Birkenhead River	46,500	74,100
Seymour River	Few	10,772
Scotch Creek	Few	1,000
Raft River	250	5,900
Chilko River	280,000	59,000
Horsefly River	1,050	11,900
Nadina River	200	21,600
Stellako River	5,230	104,800
Late Stuart	5,400	131,400
Early Stuart	6,200	580,000

To facilitate further discussion of the expected racial runs of sockeye in 1953 certain racial escapements of the year 1949 are compared with the escapements of the same races in 1941, two cycles earlier.

Since the productivity of the 1941 Chilko cycle is dropping a small run to this area is anticipated for 1953; this being the case it is obvious that newly rehabilitated spawning areas must provide the catch for the coming year.

The Early Stuart race is the earliest migrating of all of these races, and the peak of the run may be expected during the first ten days of July, the exact days of the peak run depending on the location of the fishing areas. The productivity should be low because of severe over-spawning in the brood year (1949), nevertheless the total catch should far exceed the catch for the same period during any year since 1913 at least. Following the peak of the Early Stuart run the daily catch may be expected to decline for a short period after which the Nadina and Bowron runs should compensate for the disappearing of the Stuart run. As indicated by down-stream migrant counts in 1951 and the large number of three-year jacks in 1952 the Nadina run will be relatively good considering the size of the 1949 escapement.

A combination of runs to Pitt, Horsefly, Chilko, Seymour, and Raft Rivers, and Scotch Creek will follow the Nadina and Bowron runs. Pitt River is not expected to produce a large run of four-year-old fish although five-year-old fish of this race are expected to contribute to the catch. A run of two to four hundred thousand fish originating from the Quesnel (Horsefly) area is expected to appear in the fishery, thus setting the stage for an early rehabilitation of the formerly great run to this area. Although the escapement to the Chilko River in 1949 far exceeded that of the Horsefly River for the same year, the run to Chilko is not expected to equal the Horsefly run because of a declining rate of productivity. This expectation is considerably strengthened by the fact that only 2,400,000 down-stream migrants were produced by the Chilko spawning escapement of 1949. The

run of three-year-old jack sockeye to the Horsefly area in 1952 was 2.7 times larger than the run of jacks to the Chilko area. Although the abundance of jacks is not always a reliable indicator it usually supports other information pertaining to the expected rate of racial productivity.

During August the Stellako and Late Stuart runs combined with the run to the Birkenhead River will provide the bulk of the catch. Potentially the Late Stuart run could be very large but adverse environmental factors may have seriously injured the potential productivity of this run. Nevertheless, it appears entirely possible that the 1953 run of Late Stuart fish may exceed the run of 1949. The Stellako run likewise was injured by adverse environment in 1949. The Stellako run also appears to be undergoing adjustment toward forming its dominant annual cycle of productivity, and because of this possibility and because of the poor reproductive environment in 1949 it is difficult to assess the probable size of the 1953 run to this area. An extremely small number of three-year-old fish was observed in the Stellako River in 1952. There are reasons to be optimistic regarding the 1953 Birkenhead run.

The trend of the daily catch should follow closely that of 1949 with no extremely large daily catches being made unless a full potential is realized from the spawning of one or more of the sizable racial escapements of 1949. Unlike the daily catches of this year (1952), which fell off sharply after the first few days in August, the daily catches in 1953 should remain fairly large well into the month of August. No late run of importance should be anticipated.

In spite of the added restrictions on fishing in both countries during the period of expected large catches there is reason to believe that the 1953 total catch should equal or exceed that obtained in 1949. The daily sockeye landings in Treaty waters for 1941, 1945, and 1949 are listed in Tables VII and VIII for the convenience of the industry. The escapements for the same years are detailed by spawning areas in Table IX.

REHABILITATION OF BARREN AREAS

The first adult sockeye returns from the experimental operations of the Quesnel Field Station located on Horsefly Lake will appear in 1953. The experimental operations commenced in 1949 with the taking of native Horsefly River sockeye eggs and the eventual release of 94,000 fingerlings, a portion of which were marked for future identification either in the fishery or on the spawning grounds. The fingerlings were released in Quesnel Lake at the mouth of the Horsefly River, having been transported from the hatchery rearing ponds by airplane. The purpose of this experiment was to determine whether native fish would return to their native spawning area when artificially propagated. The successful survival of the fingerlings is indicated by the return of thirteen mature three-year-old males in 1952, seven of which were marked.

In spite of the fact that the fingerlings were released in the main

Table VII

DAILY CATCH OF SOCKEYE 1941 - 1945 - 1949 FROM UNITED STATES TREATY WATERS

Date	JULY			AUGUST			SEPTEMBER		
	1941	1945	1949	1941	1945	1949	1941	1945	1949
1	329	2		108,608	45,429	111,921	3,275		
2	380				28,079	66,401	2,544	699	6,451
3	240	187		96,775	12,686	66,066	510	157	4,114
4	63	86		133,390			1,789	318	
5		163		109,463	21,428	44,124	540	886	4,205
6	525	324		55,733	13,760			577	3,641
7	1,260			27,338	10,841		2,303	270	2,198
8	1,723	2,431		20,464	11,967	70,581	343		1,447
9	1,728	4,439			7,446	52,300	171	1,035	907
10	1,394	3,919		22,514	6,354	31,270		635	580
11	1,943	2,255		15,214		27,103		448	
12		1,336		12,993	5,502	30,028		34	453
13	4,850	793		12,727	4,685			168	334
14	8,512			6,935	2,572			39	239
15	8,210	3,332		11,843	3,581	31,842			53
16	8,877	4,560			3,752	21,523		23	28
17	9,807	7,827		11,719	2,979	22,538		65	22
18	9,818	13,209		10,266		22,195		42	
19		10,581		9,557	8,210	18,901			92
20	14,646	2,484		10,305	8,018	1,266			119
21	25,053			5,848	6,808	20,585			94
22	35,830	40,316		5,295	6,360	15,265			41
23	47,969	55,804			2,706	17,382			16
24	60,166	31,730		6,860	1,854	13,054			28
25	35,150	62,722	3,916	5,302		10,503			
26		33,934	43,196	4,889	1,920	13,471			23
27	85,464	30,155	116,793	3,663	1,603	514			25
28	87,698		82,812	3,329	1,624	9,326			24
29	87,020	30,862	44,979	3,498	1,021	6,954			
30	141,289	64,272			653	6,118			
31	151,000	69,320		984	2,136	8,724			
Total	830,944	477,043	291,696	715,512	223,974	739,955	11,475	5,396	25,134
June Total	18	20							
Balance of Sept. Total							88	31	7
October Total							517		
Season Total							1,558,554	706,464	1,056,792

CLOSED

Table VIII

DAILY CATCH OF SOCKEYE 1941 - 1945 - 1949 FROM CANADIAN TREATY WATERS

Date	JULY			AUGUST			SEPTEMBER		
	1941	1945	1949	1941	1945	1949	1941	1945	1949
1	1,244			149,380	59,066	154,935	7,281		4,683
2	1,609	5,973			52,659	83,461	3,921		772
3	1,619	4,429			41,900	68,945	3,127	7,168	
4	2,552	8,109		196,510		63,618	4,110	5,005	
5		14,153		137,792		50,283	7,177	2,010	5,622
6		10,252		121,519	55,085	564		1,374	2,413
7	8,357			100,234	16,660	539			1,704
8	6,168			86,324	16,845	73,872	13,884		1,302
9	6,007	11,869			12,530	35,418	5,941		291
10	7,970	9,223			10,395	24,834	3,191	8,740	
11	8,340	8,130		94,842		36,180	3,010	5,635	
12		8,415		38,462		1,696	3,458	5,891	3,809
13		7,451		35,570	13,852	514		5,843	3,664
14	16,551			30,733	6,845				5,350
15	13,077			31,534	5,884	32,850	5,307		4,358
16	14,696	20,257			3,705	16,564	2,626		2,932
17	9,519	12,869			490	15,140	2,187	1,125	
18	11,453	17,045		34,968		15,358	1,480	409	
19		16,599	2,043	11,696		5,255	1,887	333	2,084
20		14,726	2,102	11,946	14,617	3,260		461	1,709
21	44,137		1,443	17,111	9,556	3,484			1,689
22	23,749		1,440	17,451	7,126	15,697	2,285		1,321
23	23,966	41,465			5,474	7,780	1,580		
24	34,240	31,041	100			6,792	2,120	6,227	
25	64,072	39,986	38,191	18,301		6,699	3,127	2,836	
26		48,675	28,963	6,447		5,154		2,069	6,139
27		36,153	49,822	4,185	11,212	2,321		1,308	1,544
28	201,278		64,646	3,036	3,259	2,038			455
29	128,526		4,564	3,585	4,076	12,778	2,265		1,266
30	120,842	109,052			2,357	4,585	955		
31	125,952	75,422	1,756			4,189			
Totals	875,924	551,294	195,070	1,151,626	353,593	754,803	80,919	56,434	53,107
May & June Totals	2,047	2,088	16,169						
Oct. & Nov. Totals							6,207	6,035	1,650
Season Total							2,116,723	969,444	1,020,799

CLOSED

Horsefly River at its mouth, the returning "jacks" sought the outlet of the hatchery rearing ponds. The point of return is of biological significance. Homing instinct is demonstrated in a manner which gives further weight to the findings of Dr. A. D. Hasler in regard to the functioning of the olfactory organ. It appears that the returning males found the point of release satisfactorily but upon reaching the confluence of the Little Horsefly River and the main Horsefly River they detected a difference between the two streams and entered the Little Horsefly River to return to the hatchery regardless of the fact that their parents were of the main Horsefly River stock and regardless of the fact that they had not proceeded to the sea by way of the Little Horsefly River.

The returning adults from the 1950 release of 1949 brood fingerlings of Horsefly River origin are now expected to appear at the hatchery instead of appearing on the native spawning grounds of their parents in the Horsefly River. In anticipation of their arrival, artificial spawning grounds are now being prepared for the purpose of measuring the requirements of artificial spawning grounds for successful natural spawning and incubation of sockeye eggs. Experiments also will be conducted on these fish for further measuring the effect on adult sockeye and sockeye eggs of environmental changes in the reproducing area.

A second hatchery experiment undertaken in 1949 will terminate in 1953. This experiment consisted of a transfer of eggs from the Seymour River, a tributary of the Thompson River watershed, to the hatchery for incubation and rearing. In 1950 the resultant fingerlings (84,000) were transferred by airplane to the mouth of Upper Adams River, which is also located in the Thompson River watershed. A portion of these fingerlings were marked; the failure of any marked three-year-old males of this lot to return to the hatchery in 1952 would indicate certain limitations to the possible use of the olfactory organ in the homing tendency. If adult sockeye of the Horsefly stock return to the hatchery and adult sockeye of the Seymour stock return to Upper Adams, valuable data will be obtained bearing on the requirements for a successful transfer of sockeye from one stream to another.

Operational experiments in 1952 consisted of:

1. Planting 269,000 sockeye fingerlings of the 1951 brood year in Mabel Lake in the Upper Shuswap River drainage. These fingerlings, 79,000 of which were marked, were obtained from Late Adams River spawn and flown in the "green egg" stage to the Quesnel Station for incubation, hatching, and rearing. The fingerlings were originally destined for the Seton-Anderson system but the return of a native run of considerable size to this area in 1952 indicated that further plantings in the Seton-Anderson system might not be necessary.
2. Planting 131,000 sockeye fingerlings of the 1951 brood year in the Little Horsefly River. These fingerlings, 50,000 of which were marked, were obtained from Late Adams River spawn and flown in the "green egg" stage to the Quesnel Station for incubation, hatching, and rearing.

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1941, 1945, 1949

District and Streams	*Estimated Number of Sockeye Present*		
	1941	1945	1949
LOWER FRASER			
Cultus Lake	18,164	9,231	9,301
Upper Pitt (inc. tributaries)	‡	‡	9,500
Widgeon Slough	---	1,200	650
HARRISON			
Big Silver Creek	2,000	2,000	2,100
Douglas Creek	1,100	72	250
East Creek	0	27	50
Harrison River	53,000	16,060	3,500
Hatchery Creek	150	100	10
Weaver Creek	9,200	12,944	12,520
LILLOOET			
Birkenhead River	46,500	80,553	74,100
Upper Lillooet Streams	12,800	16,111	200
SOUTH THOMPSON			
Seymour River	0	150	10,772
Scotch Creek	0	75	1,000
Adams Lake and Tribs	0	1,725	0
Adams River	50	58,000	11,700
Little River, Little Shuswap Lake	0	6,000	9,600
Shuswap Lake and Tribs	0	1,750	15
NORTH THOMPSON			
Raft River	250	3,300	5,900
CHILCOTIN			
Chilko River	280,000	186,337	59,000
Chilko Lake	---	6,547	Present
Taseko River	---	---	100
QUESNEL			
Horsefly River	1,050	3,000	11,900
Little Horsefly River	15	0	0
Mitchell River	40	---	350
NECHAKO			
Endako River	45	80	1,100
Nadina River	200	300	21,600
Nithi River	150	500	1,400
Ormonde Creek	90	400	2,500
Stellako River	5,230	20,826	104,800
STUART LAKE			
Ankwil Creek	25	0	750
Bivouac Creek	0	0	12,900
Casimir Creek	---	0	300
Driftwood River	25	---	450
Dust Creek	150	4	7,800
Fifteen-Mile Creek	5	0	200
Five-Mile Creek	5	0	600
Flemming Creek	10	2	12
Forfar Creek	1,776	7,081	80,500
Forsythe Creek	---	0	1,200
Frypan Creek	---	0	750
Gluske Creek	500	2,783	106,000
Kazchek Creek	25	952	1,500
Kynoch Creek	2,474	9,304	185,400
Leo Creek	---	0	1,700
Middle River	4,500	22,804	126,400
Narrow Creek	150	109	20,700
Point Creek	---	0	100
Rossette Creek	1,066	6,808	152,900
Cruise Creek	---	0	150
Sinta Creek	---	0	700
Shale Creek	30	250	3,000
Tachie River	900	751	5,000
Twenty-Five-Mile Creek	---	0	3,300
NORTHEAST			
Upper Bowron River	1,199	4,094	22,283

‡ Predominantly 5-year-old fish. No records of previous cycle years.
--- No observations.

The Little Horsefly River drains Horsefly Lake hence the environmental cycle calls for a late-spawning race. The Late Adams run of sockeye appears to best qualify for transfer to this area.

3. Planting 28,000 sockeye fingerlings of the 1951 brood year in Salmon Arm of Shuswap Lake at the mouth of Salmon River. These fingerlings, 15,000 of which were marked, were obtained from Seymour River spawn and flown to the Quesnel Station for incubation, hatching, and rearing.
4. Planting 23,000 sockeye fingerlings of the 1951 brood year in Anstey arm of Shuswap Lake at the mouth of Anstey River. These fingerlings, 16,000 of which were marked, were obtained from Seymour River spawn and flown to the Quesnel Station for incubation, hatching, and rearing.
5. Taking 356,000 sockeye eggs from the Seymour River in 1952 for incubation, hatching, and eventual rearing at the Quesnel Station. The fingerlings from this experiment will be planted in Upper Adams River at the head of Adams Lake.

GENERAL INVESTIGATIONS

The activities of the Commission staff are concerned each year with five major phases of the Fraser River sockeye problem. The first of these is Administration—the application of fact-finding to the regulation and protection of the fishery in accordance with the terms of reference of the Convention. The second phase may be called Management Research; this involves the collection of data for application to the fishery that maximum catch and maximum reproduction will be obtained and maintained. A third major effort of the staff is concerned with Watershed Protection. The abundance of sockeye depends largely on the maintenance of suitable and accessible freshwater environment, including migration routes, spawning areas and rearing lakes. Increasing industrialization of the Fraser watershed constantly creates new problems. The fourth category of Commission activities is that of Maintenance. The Commission operates eleven fishways at three remote, mountainous and hazardous locations. These fishways, costing approximately $2,000,000, and the access roads to them require annual repair. The Hell's Gate fishways require observation on a year-round basis. Rehabilitation of barren spawning areas is the fifth phase of the Commission's activities.

Administration, Management Research, and *Maintenance* have proceeded during the year along a previously established pattern as is illustrated in this report and in previous annual reports. *Rehabilitation* efforts are described in a preceding section. *Watershed Protection* is a rapidly expanding activity and a somewhat detailed report is presented herewith to indicate its increasing importance as the population grows in the Fraser River watershed and adjoining regions.

Watershed Protection

The Commission, under the treaty, may recommend to the Governments of Canada and the United States the removal or otherwise overcoming of

FIGURE 3A.—A co-operative experiment conducted by the Commission and the Washington Fisheries Department to measure mortality rates of salmon fingerlings passing over the 285-foot dam on Baker River. Fyke nets designed to capture fish passing over the dam are shown in the river below the spillway.

FIGURE 3B.—A co-operative experiment conducted by the Commission and the Canadian Department of Fisheries to measure mortality rates of sockeye fingerlings passing through the turbines of the 130-foot Ruskin Dam on the Stave River. The fyke nets shown are designed to catch released fish alive in velocities up to 9 feet per second.

obstructions to the ascent of sockeye salmon. Funds for fact-seeking investigations and for the removal of obstructions are provided equally by the United States and Canada, but the Commission is not a law-enforcing entity. The spawning and rearing grounds of the Fraser River sockeye lie entirely in Canadian territory, therefore the physical protection of migration routes and spawning and rearing areas is largely in the hands of the Canadian Government. The constant help of the Department of Fisheries acting within its legal limitations for the Canadian Government has been a source of great satisfaction to the Commission since the ratification of the Sockeye Convention, fifteen years ago. Without this direct help and interest it would be impossible to mediate the problems arising from the industrial development of the watershed.

In recent years, since completion of the Hell's Gate and other fishways and since the removal of several dams, the Fraser River watershed has been as accessible for Fraser River sockeye as at any time in its history. However, with the closure of the Alcan dam on the Nechako River by the Aluminum Company of Canada on October 8, 1952, a volume of flow equal to 7.6 percent of the mean flow of the Fraser River at Hope was diverted from the Fraser for all time. A problem of maintaining certain races of sockeye in the Nechako watershed will be created by this diversion of flow from the migration route in the Nechako River, and this problem has been the concern of the Commission and the Department of Fisheries of Canada since the project was announced in 1948. The principal fisheries effect of the problem will be on the runs passing through the Nechako River to spawn in the Nadina and Stellako Rivers. Sockeye runs to the Stuart system face some new hazards. Three special reports on this problem have been released. The principal hazard to certain races of sockeye is expected to be high temperatures in the residual Nechako River caused by reduction of quantity and velocity of flow. No progress has been made with the Aluminum Company of Canada on the solution for this phase of the problem. Provision has been made for a reserve of stored water in a tributary reservoir below the main dam for periodic release as an auxiliary flow for migrating adult sockeye enroute to their spawning grounds. Examination of the Nechako channel between the confluence of the Nautley River and the confluence of the Stuart River will begin in the spring of 1953, and modifications in the channel will be made if required. The problem is largely unprecedented from a fisheries point of view, and precise calculations of expected depths, velocities, and temperatures relative to the suitability of the stream for satisfactory salmon migration are difficult.

Increasing industrialization of the Fraser River watershed increases the demand for construction of hydro-electric power projects. For the past three years the Commission has conducted investigations to measure the mortality of migrant sockeye fingerlings in passing over the spillway or through the turbines at a dam, 285 feet in height, in the State of Washington. A complete report on the extent and causes of mortalities to sockeye and coho migrants at this dam is under preparation. The work has been carried

out as a mutual project with the Washington State Fisheries Department; also, assistance was given by the Canadian Department of Fisheries. Without an assessment of the extent and cause of mortalities at dams the problems of protection of down-stream migrants cannot be approached on a realistic basis. Similar work will be conducted at other dams of different design to add to our current knowledge of the problem.

In 1952 the Commission authorized a limited examination of methods and principles which might be used in saving migrants from injury and destruction caused by passing over spillways or through turbines at high dams. This investigation is divided into three phases: First, collection of information regarding the work of others in the field. Second, laboratory verification of the basic findings of other workers. Third, application of the principles established by others to guiding of Fraser River sockeye down-stream migrants. The present scope of the work is limited; currently the effort is directed toward testing the effect of electric fields on the movement of sockeye. Field tests are planned for the spring of 1953.

An announcement has been made that sulphate pulp mills may be constructed on the Fraser River in the vicinity of Quesnel and Prince George. An intensive study has been made of the possible effect of the wastes from these proposed plants on sockeye salmon and of the extent and nature of any required protection. This study has been accompanied by an investigation of the potential pulp production from the entire Fraser River watershed, which was undertaken to determine what the nature and extent of the pollution load in the Fraser River would be if the full pulp potential of the basin were developed. The reports detailing these studies have not yet been completed.

Construction of a 24-inch welded-steel oil pipeline connecting Edmonton and Vancouver was carried on during 1952. The line is scheduled for completion during 1953. Information has been gathered as to the frequency and magnitude of leakage from such lines in order to determine the potential pollution hazard at points where the line crosses or is adjacent to Fraser River tributaries. It appears that the welded, tested, corrosion-protected and well-patrolled line being installed should offer little pollution risk except through improper operation or through Acts of God. Minor damage was done to the spawning runs in the Raft River because of silt deposits resulting from belated excavation for the pipe, in spite of an arrangement that the line would be installed before spawning began.

Construction of the oil pipeline has resulted in plans for the construction of a 2,500 barrel-per-day oil refinery at Kamloops on the Thompson River. At the end of 1952 the Commission and the Canadian Department of Fisheries were beginning a detailed study of the pollution problems resulting from oil refinery waste disposal. No problem should occur if the refinery waste disposal facilities are constructed and operated in accordance with modern standards for refinery waste disposal.

The Greater Vancouver Sewerage and Drainage Board has held preliminary discussions regarding a master plan for the disposal of industrial and domestic sewage from the Greater Vancouver Area. Fisheries aspects of this preliminary plan were analyzed by the Commission at the request of the Canadian Department of Fisheries, and a general approval was given to provisions for minimizing pollution problems.

Three timber dams for storage and diversion, located on the Barriere River and its two principal tributaries, were partially removed by the B. C. Power Commission during 1952. At the year's end the removal of the dams was not complete, but it is expected that the obstructions will be entirely removed in the near future. Elimination of these dams will allow continued restoration of the sockeye runs to the system.

In late October the Commission lowered the outlet of Weaver Lake slightly to allow sufficient flow in Weaver Creek for the entrance and spawning of thousands of obstructed sockeye lying in Morris Lake. More than eight thousand sockeye entered Weaver Creek during the first day after its flow was increased. An estimated ten thousand unspawned fish died in Morris Lake because of being delayed a few days beyond their normal spawning time. However, in spite of this loss, the stream was utilized to near capacity with a total of twenty-thousand sockeye spawning successfully. Before the 1953 run is due the Commission expects to complete the construction of an outlet-control works on Weaver Lake. This will allow excess water to be stored in the lake for release during low-flow periods which occur periodically at spawning time.

1952 PUBLICATIONS

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1951.
2. Temperature Changes in the Nechako River and Their Effects on the Salmon Populations (Mimeographed). Prepared by the technical staffs of the Department of Fisheries of Canada and the International Pacific Salmon Fisheries Commission and issued by the Department of Fisheries of Canada.

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